

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 15

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TAKASHI IIZUKA

Appeal No. 97-3467
Application 08/279,748¹

ON BRIEF

Before THOMAS, HAIRSTON and LEE Administrative Patent Judges.

LEE, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1-4 and 6-12. Claim 5 has been canceled. No claim has been allowed.

References relied on by the Examiner

Takemoto et al. (Takemoto) 1990	4,975,717	Dec. 04,
Morimoto 1993	5,194,981	Mar. 16,

¹ Application for patent filed July 22, 1994. The appellant has claimed foreign priority to Japanese application 5-199484, filed August 11, 1993.

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The Rejections on Appeal

Claims 1-4 and 6-12 stand finally rejected under 35 U.S.C. § 103 as being unpatentable over Morimoto and Takemoto. Claim 1 is the only independent claim.

The Invention

The invention is directed to a laser drawing apparatus wherein the height of the drawing beams on the drawing surface is subject to a limitation to avoid distortion. Claim 1, the sole independent claim, is reproduced below:

1. A laser drawing apparatus comprising:

a splitting means comprising a beam splitter which separates laser light emitted from a laser source into two drawing beams, the beams being aligned in a common plane and a beam separator which separates each of the two drawing beams into at least two bundles of drawing beams;

a deflecting mirror having a reflecting surface which reflects and deflects the aligned drawing beams to scan a drawing surface therewith in a main scanning direction; and,

a scanning optical system which converges the beams reflected by the reflecting surface of the deflecting mirror onto the drawing surface,

wherein the height of the drawing beams on the drawing surface in said main scanning direction from the optical axis of said scanning optical system is limited to be in proportion to a deflection angle **2**;

wherein there is the following relationship:

$$\begin{aligned} * &= \cos^{-1} \{ 2 \cos \theta \times \cos^2 T - \cos \theta \} \\ (&= \tan^{-1} \{ \sin \theta / (2 \cos \theta \times \sin T \times \cos T) \} \\ (* &\sin(- \theta) < p/f \end{aligned}$$

wherein

"f" designates the focal length of the scanning optical system;

" θ " the incident angle of a drawing beam upon the reflecting surface of the deflecting mirror in a sub-scanning direction normal to said main scanning direction;

"T" the angle of a line normal to the reflecting surface of the deflecting mirror with respect to a bisector of the optical axis of the scanning optical system and the axis of an incident beam;

"p" the pitch of the aligned drawing beams;

"*" the angle of the drawing beams reflected by the reflecting surface of the deflecting mirror with respect to the optical axis of the scanning optical system; and,

"(" the angle of a line connecting an image forming point of the drawing beams reflected by the reflecting surface on the drawing surface and an intersecting point on the optical axis of the scanning optical system to the drawing surface, with respect to the sub-scanning direction.

Opinion

We do not sustain the examiner's rejection of claims 1-4 and

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6-12 as being unpatentable over Morimoto and Takemoto.

Claim 1 expressly recites the following criteria for limiting

the height of the drawing beams on the drawing surface:

wherein there is the following relationship:

$$\begin{aligned} * &= \cos^{-1} \{ 2 \cos \theta \times \cos^2 T - \cos \theta \} \\ (&= \tan^{-1} \{ \sin \theta / (2 \cos \theta \times \sin T \times \cos T) \} \\ (* &\sin(\theta - \theta') < p/f \end{aligned}$$

wherein

"f" designates the focal length of the scanning optical system;

" θ " the incident angle of a drawing beam upon the reflecting surface of the deflecting mirror in a sub-scanning direction normal to said main scanning direction;

"T" the angle of a line normal to the reflecting surface of the deflecting mirror with respect to a bisector of the optical axis of the scanning optical system and the axis of an incident beam;

"p" the pitch of the aligned drawing beams;

" θ' " the angle of the drawing beams reflected by the reflecting surface of the deflecting mirror with respect to the optical axis of the scanning optical system; and,

"(" the angle of a line connecting an image forming point of the drawing beams reflected by the reflecting surface on the drawing surface and an intersecting point on the optical axis of the

scanning optical system to the drawing surface,
with respect to the sub-scanning direction.

Instead of specifically finding this recited relationship from the disclosure of either Morimoto or Takemoto, the examiner relied

on the appellant's representation in the appeal brief that the recited relationship is for causing the resulting distortion to be "limited to the distortion free region as depicted in the upper left corner of Fig. 26" (Br. at 3). The rationale of the examiner is that if Morimoto's system similarly limits distortion, then at least a prima facie case has been made out that Morimoto's system also satisfies the host of special relationships required by claim 1 among the various parameters. This approach is logical and not improper, since the appellant did specifically state (Br. at 3):

When the claimed parameters are followed the incident angle and emission angle of the polygonal mirror are confined so that the height of the drawing beams is limited to the distortion free **region** as depicted in the upper left corner of Fig. 26. (Emphasis added.)

The problem, however, is that the examiner has misconstrued the above-quoted statement and not properly viewed the appellant's Figure 26. The term "upper left corner" as

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referenced in the appellant's brief is used not to describe the single point at the corner where the angle θ is zero degrees and the angle ϕ is also zero degrees, but the relatively distortion free "region" at the upper left corner of the graph, where the angle θ is less than 15 degrees and the angle ϕ is less than 7.5 degrees. See Figure 26.

The examiner has, erroneously, tried (answer at 3) to find in Morimoto an instance where the angle θ is zero degrees and the

angle ϕ is also zero degrees. Even assuming that the examiner finds an instance in Morimoto where the angle θ is zero degrees and the angle ϕ is also zero degrees, that would not have reasonably suggested the upper left "region" in Figure 26 where θ is a range between zero and 15 degrees and ϕ is a range between zero and 7.5 degrees, as identified by the appellant in connection with the various relationships required by claim 1. The examiner's rejection fails on this ground alone.

In addition to erroneously construing the identified "region" as a single point, the examiner has failed to explain how he determined that in Morimoto the angle θ is zero and the angle ϕ

is zero. With respect to the angle θ , which is defined in claim 1 as "the incident angle of a drawing beam upon the reflecting surface of the deflecting mirror in a sub-scanning direction normal to said main scanning direction," the examiner stated (answer at 3): "As seen in Morimoto's Figures 5 and 6, the correcting deflecting element is used to provide such an angular incidence." No explanation is made for this observation and a zero angle for θ is not self-apparent from Figures 5 and 6. We find that the examiner has not shown how Figures 5 and 6 of Morimoto discloses that the angle of incidence of the drawing beam on the reflecting surface is zero.

The examiner also further erroneously determined that in Morimoto the angle ϕ is zero. The angle ϕ is defined in claim 1 as "the angle of a line normal to the reflecting surface of the deflecting mirror with respect to a bisector of the optical axis of the scanning optical system and the axis of an incident beam." That is the same definition as set forth on pages 4 and 19 of the appellant's specification. As is illustrated in Figure 9 of the specification, the angle ϕ is really a variable,

depending on the angular position of the reflecting polygon mirror 46. In that illustration, the reference point of θ is where θ equals zero. But when the mirror moves to another position as indicated in dashed lines, evidently θ takes on a certain value.

As defined in claim 1, θ is the angle between a line normal to the reflecting surface and a line which bisects the angle between the incident beam and the optical axis of the optical scanning system, i.e. line O in Figure 26. It changes as the position of the reflecting mirror changes. The examiner, however, erroneously finds (answer at 4) that "the law of reflection provides for the normal to the surface and the bisector to be coincident." On that erroneous basis, the examiner concludes that θ is zero in Morimoto. It is apparent that the examiner is referring to a different

bisector, namely, the bisector of the angle formed by the incident beam and the reflected beam, rather than the bisector called for by the appellant's claim. Based on the examiner's reasoning, the angle θ would always be zero, since the normal

and the bisector by definition would coincide with each other. But that is not the angle θ defined in the appellant's claim, which is measured with respect to a different bisector.

Because the examiner failed to establish that Morimoto's device satisfies the requirement of limiting distortion to that represented by the upper left corner region shown in appellant's Figure 26, there is no basis for the examiner to conclude that Morimoto inherently satisfies the various equations set forth in claim 1 between the many pertinent parameters in the system. Takemoto has not been relied on for any teaching in connection with this aspect of the appellant's claimed invention.

In the final Office action (Paper No. 11), the examiner stated: "It is well known in the art of optical systems that the closer the light is to the optical axis, the less distortion and aberration is induced by the optical components." But that general recognition is far from adequate to constitute a reasonable suggestion for the specific formulas recited in claim 1 or for

particular identification of the upper left corner region in appellant's Figure 26 involving both angles θ and ϕ . The examiner has not presented any evidence that the basic level of

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skill and knowledge possessed by one with ordinary skill in the art would have included the recognition that the specific region focused on by the appellant in Figure 26 has a particular significance insofar as reduction of distortion is concerned.

For the foregoing reasons, we do not sustain the rejection of claims 1-4 and 6-12 over Morimoto and Takemoto.

Conclusion

The rejection of claims 1-4 and 6-12 under 35 U.S.C. § 103 as being unpatentable over Morimoto and Takemoto is reversed.

REVERSED

JAMES D. THOMAS)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
KENNETH W. HAIRSTON)	
Administrative Patent Judge)	APPEALS AND
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)	INTERFERENCES
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JAMESON LEE)	
Administrative Patent Judge)	

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Gerald Levy
Kane, Dalsimer, Sullivan, Kurucz
Levy, Eisele & Richard
711 Third Avenue
New York, NY 10017-4059